REFERENCES

1. Reuter, K., and Andrews E., Proc. Soc. Exper. Biol. and Med. xxvi, 17, 1928.
2. de Quervain, F., and Smith, W. E., Personal Communication.
3. Lunde, G., et al., Klin. Wcnschr., vii, 2287, 1928.
4. Dragstedt, L., and Ellis, J. C., Proc. Soc. Exper. Biol. and Med., xxvi, 305, 1929.
5. Orr, T. G., and Haden, R. L., J. Exper. Med., xlviii, 339, 1928.
6. Curtis, G. M., and Janovsky, F., Unpublished data.
7. Underhill, F. P., et al., Arch. Int. Med., xxxii, 31, 1923.
8. Abel, J. J., Rowntree, L. J., and Turner, B. B., Jour. Pharmacol. and Exper. Ther., v, 275, 1914; also v, 625, 1914.
9. Heusser, H., and Werder, H., Beit. z. Klin. Chir., cxli, 38, 1927.
10. Engel, D., and Kerekes, A., Ztsch. f. d. ges. exper. Med., lv, 574, 1927.
11. Cohnheim, O., Ztsch. f. Biol., xxxvii, 443, 1899.
12. Curtis, G. M., Biochem. Ztschr., clxiii, 109, 1925.
13. Curtis, G. M., Biochem. Ztschr., clxxxvi, 95, 1927.
14. Curtis, G. M., and Pacheco, G. A., Proc. Soc. Exper. Biol. and Med., xxvi, 874, 1929.

ASPIRATION IN TONSILLECTOMY—COMPARATIVE MERITS OF POSTURE AND OTHER FACTORS*

A BRONCHOSCOPIC STUDY OF ONE HUNDRED AND TEN PATIENTS

Research Prize Paper of the Fifty-Ninth Annual Session of the California Medical Association

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ONE-THIRD of all the surgical operations since 1924 among the American urban population are said to have been for the removal of tonsils and adenoids.[1] With the apparent increase of incidence of postoperative pulmonary complications, the problem of ascertaining the factors that might lead to the production of lung abscess merits earnest consideration.

In recent years much light has been shed on the etiology of postoperative complications. Concerning their causation, investigators in this field are now divided into two schools of thought: those who hold to the embolic, and those who defend the aspiration theories. That infecting emboli play a distinct part in some cases of lung abscess is well supported by both clinical and experimental evidences as shown by Cutler and Hunt,[2] Schlueter and Werdlein,[3] Fetterolf and Fox,[4] and many others. It is also true that under certain circumstances, the aspiration of infected material into the air passages contributes to the causation of lung abscess, a fact which is demonstrated by the works of Hoelscher,[5] Lemon,[6] Smith,[7] Crowe and Scarff,[8] Allen,[9] Ochsner and Nesbit,[10] Myerson,[11] Iglauer,[12] and recently by May and his associates.[13] A careful review of recent literature on this subject impresses one with the fact that the pendulum of medical thought is swaying toward the side of the aspiration theory.

INCIDENCE

The first lung abscess following tonsillectomy in this country was reported in 1912 by Richardson.[14] Moore [15] estimated the incidence of lung abscess as once in 2500 to 3000 posttonsillectomies. That rate was based on a nation-wide survey by means of comprehensive questionnaires sent out to various throat specialists. Moore thus assembled 202 cases of lung abscess most of which followed tonsillectomy, thirty-nine of the tonsillectomies having been done under local anesthesia. Cutler and Schlueter [16] collected from the literature a total of 1908 cases of pulmonary abscess; 29 per cent of these followed operative procedures, and of such 14.6 per cent occurred after the removal of tonsils. In a series of 602 cases of pulmonary abscess which were observed at the Mayo Clinic by Hedblom,[17] 146 followed operations. Of these operative cases, forty-eight occurred after tonsillectomy.

From the records at the Massachusetts General Hospital the writer collected sixty cases of pulmonary complications which were recorded in the period between May 1921 and October 1927. This series included forty-five lung abscesses, eight lobar pneumonias, four cases of bronchiectasis, and three cases of bronchopneumonia. All followed operations on the upper respiratory tract, chiefly on tonsils and adenoids under inhalation ether anesthesia. Of these sixty patients, thirty-nine were operated on elsewhere than at the Massachusetts General Hospital. When the complications later developed, the patients sought medical aid in the above hospital. The remaining twenty-one cases included two bronchopneumonias, eight lobar pneumonias, and eleven lung abscesses. These patients had been operated on either at the Massachusetts General Hospital or at the Massachusetts Charitable Eye and Ear Infirmary, these two institutions being under the same management. During this same period the average number of tonsillectomies performed each year in these two institutions was 3356. This places the actual known incidence of lung abscess in these two institutions as one in every 2678 tonsillectomies.

SCOPE OF EXPERIMENT

By means of bronchoscopic studies Myerson [10] and Iglauer [11] have shown that 40 to 77.5 per cent of patients, immediately following tonsillectomy under ether anesthesia, revealed the presence of blood and mucus in some portion of the bronchial tree. Iglauer reported that when tonsils were removed under local anesthesia, aspiration

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Editors' Note.—This paper was submitted under the nom de plume, Rose Trendelenburg, and received the 1930 Research prize of $150 at the fifty-ninth annual session of the California Medical Association, Del Monte, April 28 to May 1, 1930. The name of the institution and other identifying references were lacking in the manuscript, but have been inserted by the editor.

Two prizes are awarded by the Association at each annual session—one for the best paper on a clinical subject, the other for the best paper on a research subject. Application to the central office of the Association will bring a leaflet which explains the requirements and rules governing the awards.

took place in 28 to 30 per cent of cases, though with less quantity and penetration.

It is recognized that the normal tracheobronchial system, aside from its ciliary movement, cough reflex, and "peristaltic" action, has inherent tissue immunity against bacterial invasion from the upper respiratory tract. However, in the light of our present knowledge, should any aspirated blood become infected, where could one find more favorable conditions for a good culture medium?

The following studies were made in order to evaluate the various factors which contribute to the causation of aspiration complications.

CLINICAL MATERIAL

The series here reported consists of 110 patients, fifty-four males and fifty-six females, three to fourteen years of age, who came to the laryngological service at the White Memorial Clinic for the removal of tonsils and adenoids in

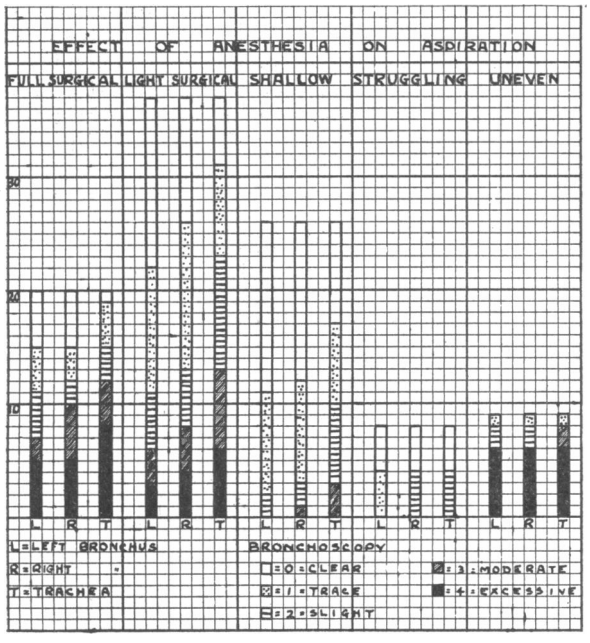

Chart 1-A.—Showing diagrammatically, the effects of different types of anesthesia on aspiration evidences in trachea and bronchi.

the period between April 1929 and January 1930. Each patient received preliminary physical and laboratory examinations, such as urinalysis and bleeding and coagulation times. When the patient gave a history of acute illness within the two weeks before the date set for operation, the operation was postponed and the patient was given a later appointment.

All operations were performed in the forenoon. Unless there was a contraindication, each patient was discharged the same evening, after a throat examination had been made. Each patient received a printed instruction card for the postoperative home care. When emergencies arose after a patient left the clinic, a house call was made by one of the staff on service. Each patient was asked to report to the clinic, when surgical convalescence seemed complete, for a final

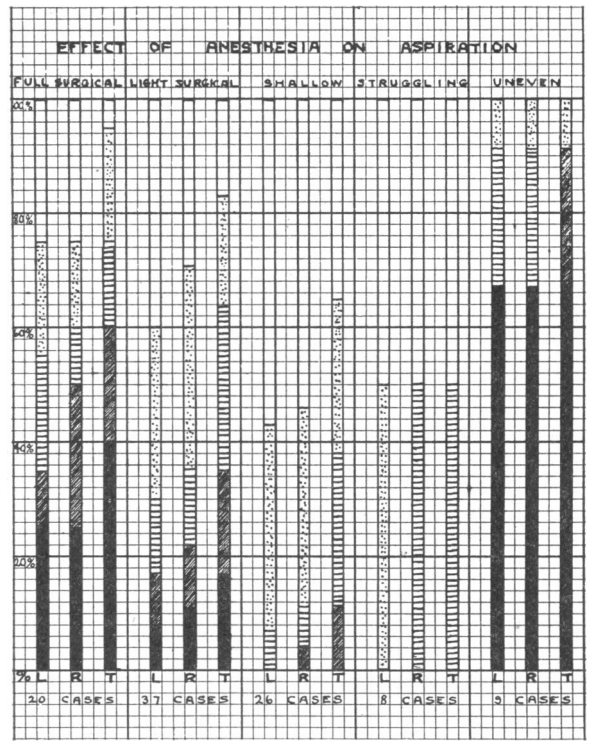

Chart 1-B.—Showing diagrammatically, the effects of different types of anesthesia on aspiration evidences, as noted in different patient groups.

check-up. About fifty patients did return to the clinic for this purpose. To those patients who failed to come back for the final examination, a social service worker was sent to ascertain the after-effects of the operation, with special reference to the presence of cough, fever, precardial pain, and other signs that might point to the presence of a pulmonary complication.

Tables 1 to 6 reveal the scope of the study and the various factors that were considered.

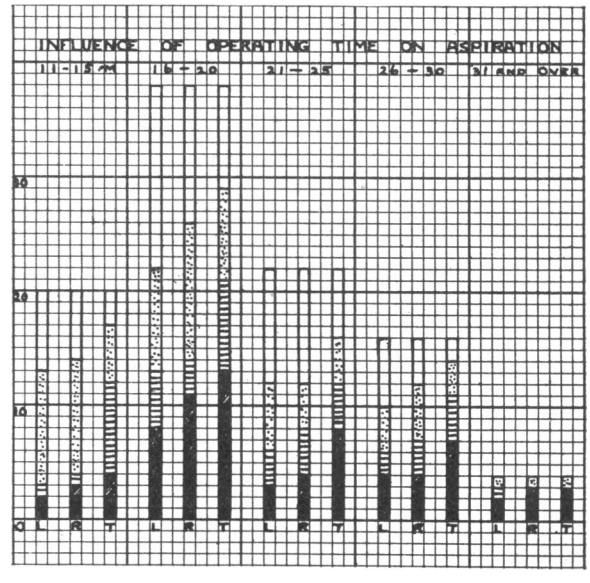

Chart 2-A.—Showing the influence of operative time on aspiration complications (in relation to the trachea and bronchi).

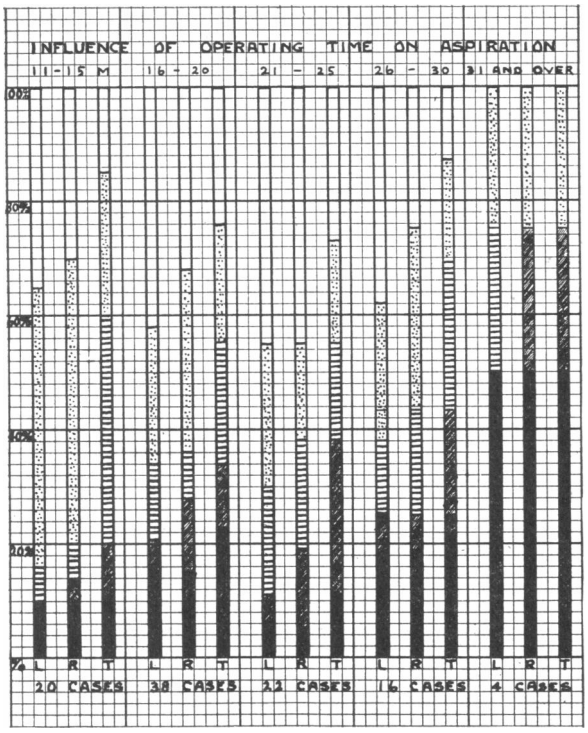

Chart 2-B.—Showing the influence of operative time on aspiration complications (in relation to certain patient groups).

When the bleeding was entirely controlled and the pharynx dry, a direct tracheobronchoscopy was performed by the writer. The contents of each main bronchus and of the trachea were noted and graded according to the amount of blood and mucus present. Where no blood was found it was recorded as zero (0), whereas when the secretion flowed out of the examining-tube mouth, it was designated as four (4). Between these two extremes the various amounts of the contents present were graded according to the number of uniform-sized sterilized sponges which were necessary to dry the air passages. There were forty-five different physician and student operators in this series of tonsillectomies. All used the dissection and snare method. The La Force adenotome was employed for adenoidectomies.

ETHER

The open cone method of inhalation anesthesia was employed at the beginning of each anesthesia. Just before the operation began, this was changed to compressed-air vaporization from which apparatus a rubber tube carried the ether to the angle of the patient's mouth. Earlier in the series the exact amount of ether used for each patient was noted, but it soon became apparent that the amount consumed was influenced by so many different factors that the amounts used were omitted from the final tabulations. The induction time was counted as from the beginning of etherization to the moment when the mouth gag was introduced.

The effects of anesthesia observed on the patients were recorded in five groups as follows: Full Surgical, Light Surgical, Shallow, Struggling, and Uneven (Charts 1-A and 1-B). To maintain a constant degree of anesthesia in a patient for any length of time requires considerable skill and experience. This is particularly so in a tonsillectomy operation, where the mouth is kept wide open and where suction also is used. In estimating the degree of narcosis we were guided by the general reaction of the patient throughout the operation.

It would seem that a shallow anesthesia is preferable to a full or to a light surgical one. Although struggling patients are at times difficult to manage, yet the frequency of aspiration complications seem to be less.

SUCTION

The usefulness of suction in the operation of the upper respiratory tract is universally recognized. In the series here reported, the water-suction tube was used and manipulated by an assistant. In patient 73, the suction was not used; nevertheless only a trace of blood was found in the trachea and none at all in the bronchi of the patient. In patients 83 and 100, each patient was operated on in the Rose position. Patient 83 had an unusually large quantity of blood in the lower air passages, but patient 100 had very little blood

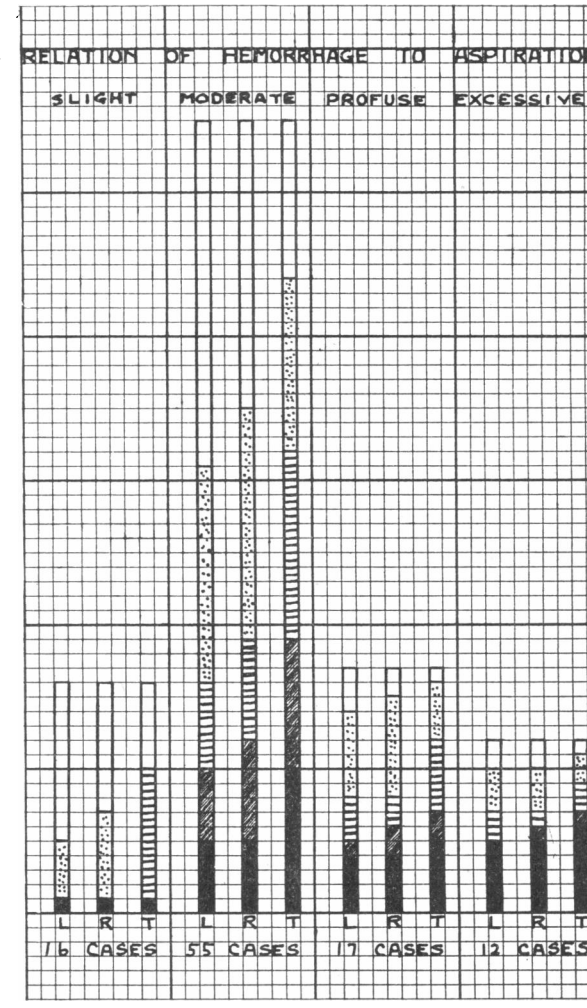

Chart 3-A.—Showing the relation of hemorrhage to injection of the air passages.

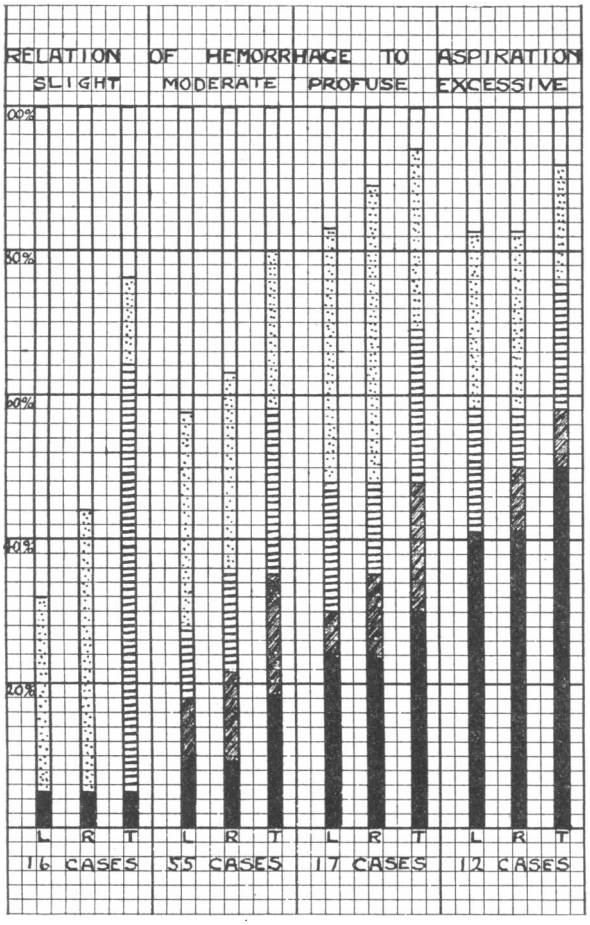

Chart 3-B.—Showing the relation of hemorrhage to the injection of the air passages.

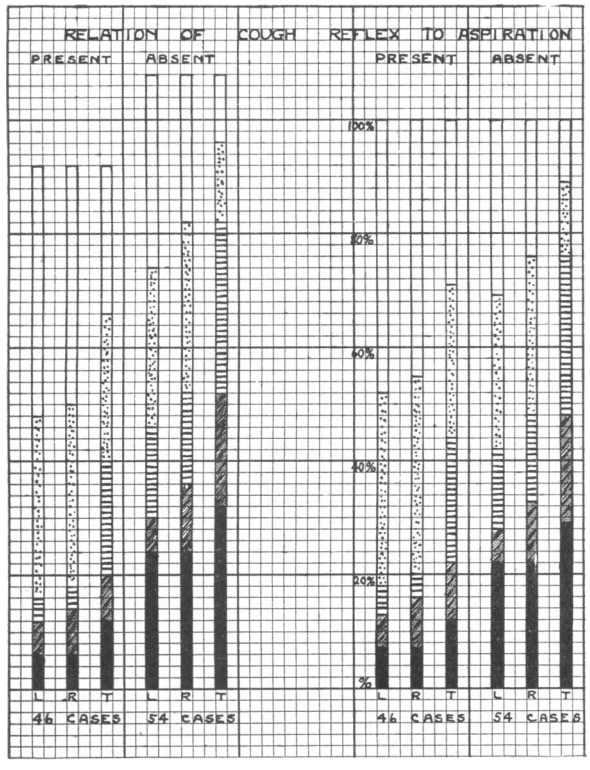

Chart 4.—Showing the relation of cough to aspiration.

or secretion. It is evident that suction has a place in tonsillectomy operations, but the belief that suction when constantly applied prevents the downward flow of pharyngeal contents seems to be erroneous.

OPERATING TIME

The influence of the operating time on aspiration complications is represented in Charts 2-A and 2-B. It would seem therefrom that the operating time had slight influence on the amount of aspiration. At least, the amount actually present within the air passages at the conclusion of the surgical procedures, whether long or short, was on the average the same.

HEMORRHAGE

A slight loss of blood is inevitable in tonsillectomy operations. According to the number of sponges required and the constancy of suction applied, the quantity lost was numerically estimated as follows: 1, slight; 2, moderate; 3, profuse; and 4, excessive.

Charts 3-A and 3-B show the relation of hemorrhage to the injection of the air passage.

COUGH AND VOMITING

Much has been written concerning the relation of the cough reflex to the incidence of aspiration under inhalation ether anesthesia. Experience has shown that the threshold of cough reflex is subject to considerable variation in different individuals. It would seem, however, that coughing does guard against aspiration of a large quantity of secretion and undoubtedly helps to clear the air passage by expelling that which finds its way downward. Chart 4 throws light on this.

Theoretically, a sudden regurgitation of the gastric contents into the pharynx immeasurably increases the danger of aspiration. It is well known, however, that the vomiting center is much earlier depressed by ether than is the cough reflex. Thus the action of the cough reflex doubtless often protects the air passages in patients where vomiting takes place. Of the thirty-seven patients who both vomited and coughed, seventeen had clean lungs, and ten had slight traces of blood.

POSTURE

This is the phase of the work on which our original classification was made. Six distinct postures of the head relative to the body were used. Five groups consisted of twenty patients each, and the sixth of ten patients. These postures are considered in turn.

Moderate Extension.—In this position the patient had no support of head other than the hands of the anesthetist who held it in moderate extension (Fig. 1).

Extreme Extension.—A small sand-bag was placed under the shoulders (Fig. 2). This caused extreme extension of head.

Trendelenburg at Twenty Degrees.—The foot of the operating table was elevated to form an angle of twenty degrees. A sand-bag supported the shoulders (Fig. 3).

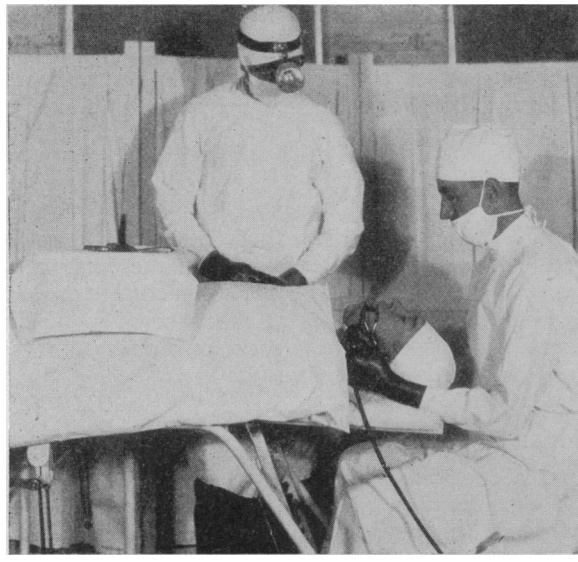

Fig. 1.—Moderate extension position.

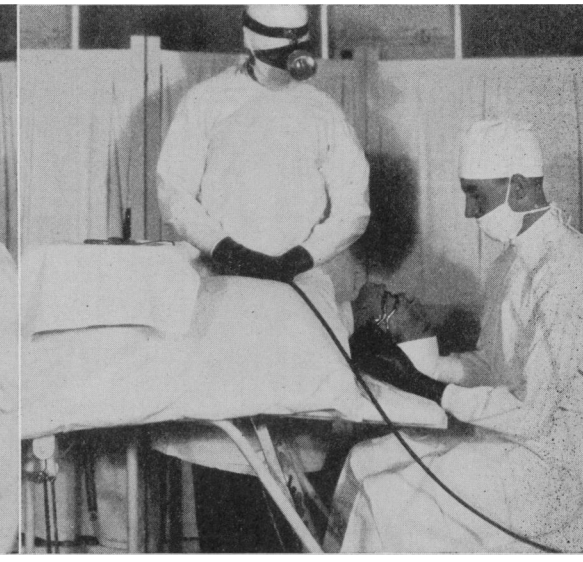

Fig. 2.—Extreme extension position.

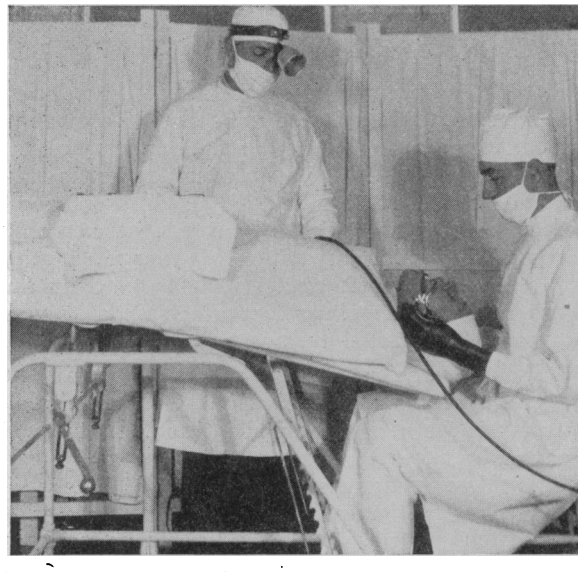

Fig. 3.—Twenty degree Trendelenburg position.

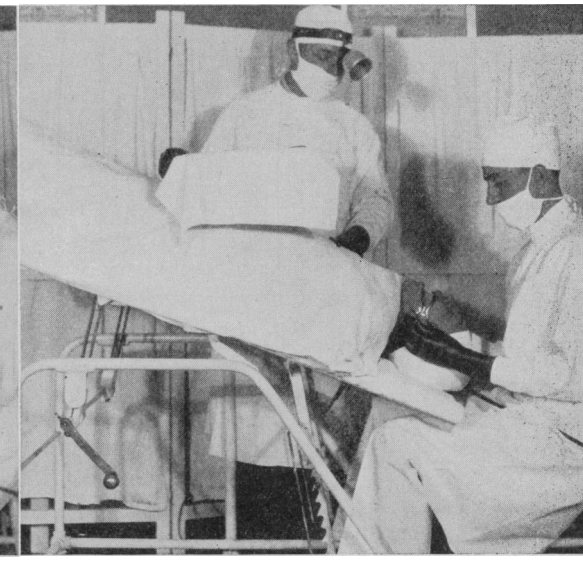

Fig. 4.—Forty-five degree Trendelenburg position.

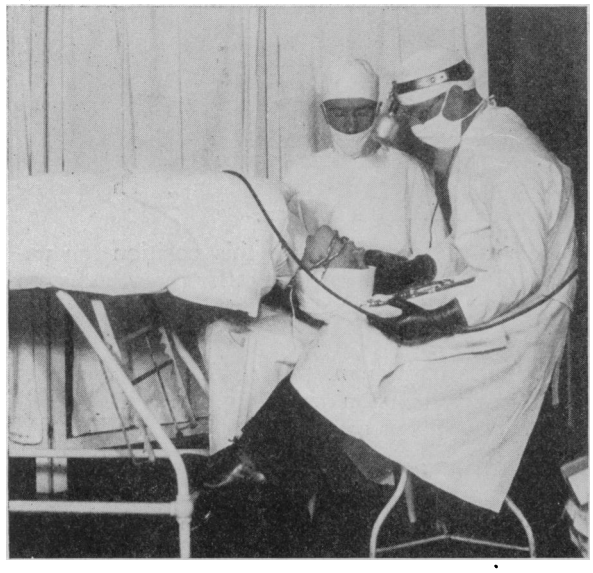

Fig. 5.—Rose position.

Fig. 6.—Bostonian position

Trendelenburg at Forty-Five Degrees.—This was like the preceding position except for extreme elevation of the foot of the table. It was necessary to strap the patient firmly to the table to prevent slipping toward the anesthetist (Fig. 4).

Rose Position.—The head of the patient was at the end of the operating table and the vertex supported by a pillow on the operator's lap. Thus the head was maintained on a much lower plane than the rest of the body (Fig. 5).

Bostonian.—As there were only ten patients in this group we did not include all the data in this study. However, it is none the less interesting from an academic viewpoint. For lack of a proper descriptive term we called the position shown in Fig. 6 the Bostonian. Practically all tonsillectomies in and about Boston are performed in this manner. After the patient is anesthetized he is strapped to a specially constructed chair for this purpose and brought into the operating room. Here he is placed before the surgeon in sitting posture. The trained nurse, who stands behind the patient, steadies the head and can readily turn or tip it in whichever direction indicated by the surgeon. Both the operator and the assistant have a free view of the field. Any advantages of position are apparently offset by the aspiration of blood and secretions which gravitate into the air passages in spite of care taken in the use of suction and sponges. The ten patients who were operated upon in this position had a uniformly large amount of blood (Chart 6). Aside from the climatic conditions and seasonable variations ascribed by Lord,[18] the unusually high incidence of pulmonary complications that occur following tonsillectomy in the city of Boston may, to some degree, be attributed to the use of this position.

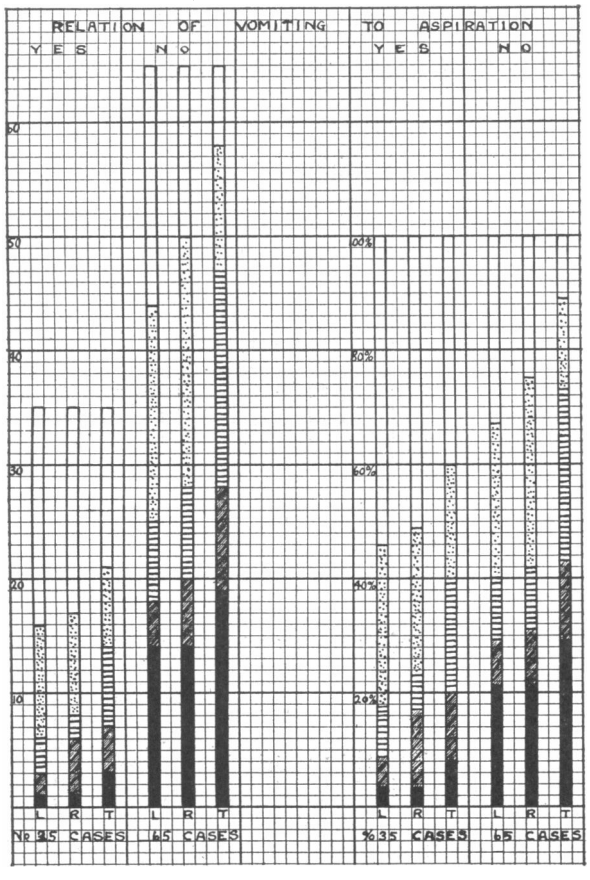

Chart 5.—Showing the relation of vomiting to aspiration.

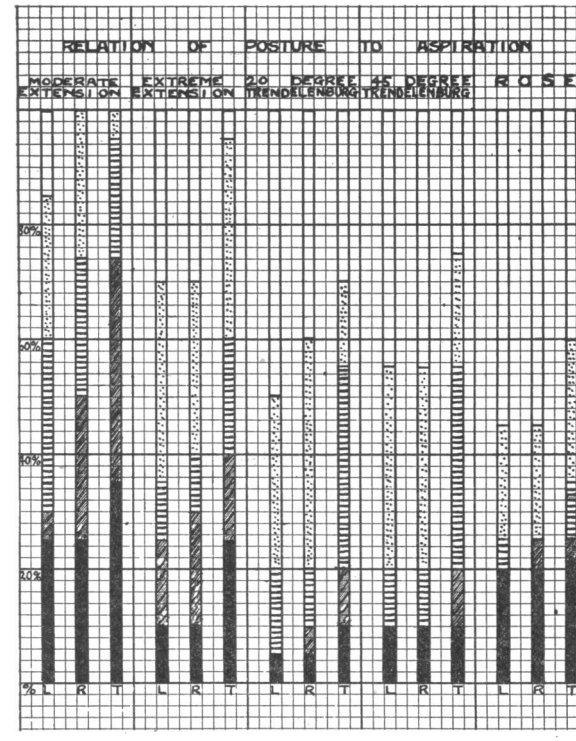

Chart 6.—Showing the relation of posture to aspiration.

Table 7 indicates analysis of twenty-one cases, including seven patients who were operated on in Bostonian posture, in which there was excessive aspiration.

The analysis of thirty-two cases in which there was no blood or barely a trace of it in the lower air passages of the patients is shown in Table 8. A remarkable feature of this table is that there is included not a single case from either the moderate extension or Bostonian group.

SUMMARY

1. Bronchoscopic study immediately following operation seems to offer one of the best methods of the estimation of the amount of inspired blood and secretions present after a tonsillectomy operation.

2. The Rose position affords the greatest protection against aspiration. The next in order are: the Trendelenburg, the extreme extension, and the moderate extension. The Bostonian posture gave the largest amount of aspiration.

3. Anesthesia should be as light as is compatible with careful surgical manipulation. The deeper the narcosis the greater will be the amount of aspirated material.

4. Suction and dry sponges as at present used during tonsillectomy are useful armamentaria, but

TABLE 1.—*Moderate Extension*

No.	Name	Age	Sex	History	Induction Time	Degree of Anesthesia	Operators	Time	Hemorrhage	Suction Applied	Vomited	Coughed	Bronchoscopy Left	Bronchoscopy Right	Bronchoscopy Trachea
1	V. C.	13	M.	Repeated colds	25 M.	Shallow	F. H. L.	25 M.	2	Intermittent	Yes	No	2	3	3
2	O. L.	5	F.	Hypertrophic tonsils	5 M.	Shallow	C. C. H.	35 M.	3	Intermittent	Yes	Yes	2	3	3
3	S. P.	4	F.	Repeated colds	10 M.	Light surgical	J. W. H.	30 M.	2	Intermittent	No	No	2	2	3
4	B. R.	5	F.	Repeated colds	10 M.	Light surgical	T. W. K.	30 M.	1	Intermittent	No	No	0	1	2
5	I. L.	5	M.	O. M. S. A.	10 M.	Light surgical	W. C. C.	20 M.	2	Intermittent	No	No	0	1	2
6	I. L.	8	F.	Repeated colds	10 M.	Light surgical	W. C. C.	30 M.	2	Intermittent	No	No	1	2	3
7	E. P.	7	F.	"Colds"	10 M.	Light surgical	T. E. W.	28 M.	2	Intermittent	No	No	0	1	2
8	J. H.	8	F.	"Running nose"	10 M.	Light surgical	C. C. P.	34 M.	2	Intermittent	No	No	1	1	1
9	E. B.	9	M.	Septic tonsils	9 M.	Light surgical	J. W. H.	11 M.	4	Intermittent	No	No	4	4	4
10	W. C.	8	M.	Nasal obstruction	10 M.	Light surgical	J. W. H.	16 M.	4	Intermittent	No	No	2	2	3
11	R. C.	6	M.	Nasal obstruction	6 M.	Light surgical	C. S. I.	15 M.	2	Intermittent	No	No	1	2	3
12	H. B.	7	M.	Nasal obstruction	4 M.	Full surgical	C. S. I.	20 M.	4	Intermittent	No	No	2	3	4
13	R. R.	12	F.	Chronic tonsillitis	6 M.	Light surgical	C. S. I.	24 M.	2	Intermittent	No	No	2	2	3
14	E. A.	7	F.	Chronic tonsillitis	10 M.	Light surgical	R. T. H.	17 M.	2	Constant	Yes	Yes	3	3	4
15	R. O.	4	M.	Repeated colds	6 M.	Full surgical	C. B.	32 M.	2	Constant	No	No	4	4	4
16	T. H.	4	M.	Repeated colds	5 M.	Light surgical	M. E. C.	28 M.	2	Intermittent	No	No	4	4	4
17	A. A.	3	M.	Repeated sore throat	8 M.	Shallow	T. E. G.	22 M.	2	Constant	Yes	Yes	1	2	3
18	A. D.	5	F.	Nasal obst. O. M. C. A.	8 M.	Light surgical	E. B. C.	20 M.	2	Constant	No	No	4	4	4
19	C. M.	9	M.	Nasal obstruction	10 M.	Light surgical	J. H.	20 M.	3	Constant	No	Yes*	4	4	4
20	D. S.	5	M.	Chronic tonsillitis	14 M.	Struggling	M. E. C.	15 M.	3	Intermittent	No	Yes	1	1	2

* Yes, at beginning.
M—Minutes.

Hemorrhage
1—Slight.
2—Moderate.
3—Profuse.
4—Excessive

Bronchoscopy
0—Clear.
1—Trace.
2—Slight.
3—Moderate.
4—Excessive.

TABLE 2.—*Extreme Extension*

No.	Name	Age	Sex	History	Induction Time	Degree of Anesthesia	Operators	Time	Hemorrhage	Suction Applied	Vomited	Coughed	Bronchoscopy Left	Bronchoscopy Right	Bronchoscopy Trachea
21	A. M.	7	F.	Continuous colds	12 M.	Light surgical	W. G. H.	30 M.	1	Intermittent	No	Yes*	0	0	1
22	S. B.	8	F.	"Underweight"	10 M.	Shallow	H. J. H.	20 M.	2	Intermittent	Yes	Yes	1	1	2
23	W. R.	3	M.	Repeated colds	10 M.	Full surgical	M. A. D.	24 M.	2	Intermittent	No	No	1	2	3
24	J. C.	8	F.	Hypertrophic tonsils	8 M.	Full surgical	R. B. G.	19 M.	2	Intermittent	No	No	3	3	4
25	M. M.	8	F.	Repeated sore throats	8 M.	Full surgical	C. B.	27 M.	3	Constant	No	No	4	4	4
26	R. M.	10	M.	Impaired hearing	18 M.	Full surgical	L. L. H.	12 M.	2	Constant	No	No	2	3	3
27	V. C.	6	F.	Repeated sore throat	12 M.	Shallow	H. H. H.	28 M.	4	Constant	No	Yes	1	1	2
28	R. C.	7	M.	Nasal obstruction	17 M.	Light surgical	L. C. C.	16 M.	2	Constant	No	No	1	1	2
29	H. S.	7	M.	Repeated sore throat	20 M.	Full surgical	C. B.	21 M.	2	Constant	No	No	1	1	2
30	M. C.	14	F.	Hypertrophic tonsils	10 M.	Light surgical	S. K. B.	20 M.	2	Constant	Yes*	No	0	0	0
31	L. M.	11	F.	Chronic follicular tonsils	10.M.	Light surgical	E. B. C.	20 M.	2	Constant	No	No	1	1	2
32	D. G.	6	M.	"Slow mental development"	19 M.	Light surgical	H. H. L.	26 M.	2	Intermittent	No	No	3	3	4
33	M. F.	13	F.	Chronic naso-pharyngitis	7 M.	Shallow	T. E. G.	13 M.	2	Constant	Yes	Yes	0	0	1
34	C. Mc.	7	M.	Chronic hypertrophic tonsils	20 M.	Light surgical	S. K. B.	20 M.	2	Constant	No	No	0	0	1
35	R. O.	14	F.	Referred by school doctor	25 M.	Uneven (elec. trouble)	H. J. H.	20 M.	4	Intermittent	No	Yes†	4	4	4
36	R. N.	5	M.	Repeated sore throat	15 M.	Shallow	L. L. H.	20 M.	3	Constant	Yes	Yes	0	0	1
37	M. Mc.	5	F.	Septic tonsillitis	15 M.	Uneven	I. W. K.	20 M.	2	Constant	Yes	Yes	1	1	1
38	M. W.	12	F.	Repeated sore throat	15 M.	Light surgical	J. B. P.	17 M.	4	Constant	No	Yes*	1	1	1
39	S. J.	12	M.	Chronic tonsillitis, possible tuberculosis	13 M.	Light surgical	G. K.	19 M.	3	Constant	No	Yes*	3	3	4
40	M. E.	6	F.	Enlarged tonsils. O. M. C. A.	12 M.	Light surgical	H. J. H.	12 M.	2	Constant	No	Yes*	0	0	1

* Yes, at beginning.
† Yes, toward end.

TABLE 3.—*Trendelenburg, Twenty Degrees*

No.	Name	Age	Sex	History	Induction Time	Degree of Anesthesia	Operators	Time	Hemorrhage	Suction Applied	Vomited	Coughed	Bronchoscopy Left	Bronchoscopy Right	Bronchoscopy Trachea
41	N. A.	6	F.	Sore throats	10 M.	Shallow	H. J. H.	12 M.	3	Intermittent	No	Yes	1	1	2
42	N. B.	5	M.	Enlarged tonsils. Sinusitis	7 M.	Light surgical	H. H. H.	21 M.	2	Intermittent	Yes†	No	3	3	4
43	C. B.	9	M.	Repeated sore throat	14 M.	Full surgical	H. H. H.	24 M.	4	Intermittent	No	No	4	4	4
44	C. C.	3	M.	Septic tonsils	6 M.	Full surgical	H. H. H.	16 M.	3	Intermittent	No	No	0	1	1
45	J. B.	6	M.	Nasal obstruction. Repeated colds	16 M.	Shallow	H. J. H.	12 M.	2	Intermittent	Yes†	Yes	0	0	0
46	A. M.	6	F.	Nasal obstruction. Repeated colds	15 M.	Struggling	J. J. J.	22 M.	3	Constant	Yes	Yes	1	1	2
47	A. A.	6	M.	Bilat. sinusitis. Septic tonsils	10 M.	Struggling	F. E. I.	15 M.	4	Constant	Yes	Yes	1	1	2
48	J. O.	3	F.	Repeated colds	10 M.	Struggling	R. T. H.	11 M.	2	Constant	No	No	1	1	2
49	O. P.	3	F.	Enlarged tonsils	10 M.	Full surgical	H. H. H.	20 M.	3	Constant	No	No	4	4	4
50	N. N.	5	F.	Repeated colds	15 M.	Light surgical	G. McC.	28 M.	1	Intermittent	No	No	0	0	1
51	E. H.	6	F.	Repeated colds	15 M.	Shallow	H. F. E.	28 M.	2	Intermittent	No	Yes	3	3	4
52	J. G.	5	F.	Repeated colds	15 M.	Light surgical	H. J. H.	16 M.	1	Intermittent	No	No	0	1	2
53	M. S.	8	M.	Nasal obstruction	10 M.	Struggling	H. J. H.	20 M.	1	Intermittent	Yes	Yes	0	0	0
54	J. C.	10	M.	Chronic tonsillitis	9 M.	Struggling	J. B. O.	24 M.	1	Intermittent	Yes	Yes	0	0	0
55	F. M.	7	M.	Nasal obstruction. Cont. colds	7 M.	Full surgical	J. D. L.	13 M.	1	Intermittent	No	No	1	1	2
56	E. P.	7	M.	Nasal obstruction	10 M.	Light surgical	J. B. O.	18 M.	1	Intermittent	No	No	1	1	2
57	H. R.	5	M.	Dysphagia	9 M.	Struggling	E. W. G.	18 M.	1	Intermittent	Yes	Yes	0	0	0
58	J. G.	5	M.	Repeated colds	9 M.	Shallow	E. W. G.	15 M.	1	Intermittent	Yes	Yes	0	0	0
59	W. M.	7	M.	Nasal obstruction	9 M.	Shallow	E. W. G.	19 M.	1	Intermittent	Yes	Yes	0	0	0
60	E. S.	13	M.	Nasal obstruction. Repeated sore throat	11 M.	Shallow	H. J. H.	11 M.	2	Intermittent	Yes	Yes	0	1	1

† Yes, toward the end.

TABLE 4.—*Trendelenburg, Forty-Five Degrees*

No.	Name	Age	Sex	History	Induction Time	Degree of Anesthesia	Operators	Time	Hemorrhage	Suction Applied	Vomited	Coughed	Bronchoscopy Left	Bronchoscopy Right	Bronchoscopy Trachea
61	J. C.	6	M.	Nasal obstruction	10 M.	Light surgical	H. J. H.	11 M.	2	Constant	Yes	Yes*	1	1	2
62	A. K.	4	M.	Repeated sore throat	5 M.	Shallow	E. W. G.	23 M.	3	Constant	Yes	Yes	1	1	2
63	A. M.	11	F.	Repeated quinsy	12 M.	Shallow	E. W. G.	20 M.	2	Constant	Yes	Yes	0	0	0
64	E. B.	13	F.	Repeated headache	8 M.	Shallow	E. W. G.	18 M.	3	Constant	Yes	Yes	0	0	0
65	W. H.	6	M.	Repeated sore throat	5 M.	Shallow	E. W. G.	15 M.	1	Constant	Yes	Yes	0	0	0
66	B. G.	10	F.	Repeated sore throat	11 M.	Light surgical	E. W. G.	12 M.	2	Constant	Yes	Yes*	1	1	2
67	B. C.	5	F.	Repeated colds	6 M.	Light surgical	H. J. H.	16 M.	2	Constant	No	No	0	0	0
68	L. M.	7	F.	Repeated colds	8 M.	Light surgical	M. A. D.	22 M.	2	Constant	No	No	0	0	1
69	M. G.	10	F.	Repeated sore throat	11 M.	Light surgical	H. H. H.	21 M.	2	Constant	Yes	No	1	1	2
70	S. T.	6	M.	Frequent epistaxis	5 M.	Light surgical	C. T. H.	28 M.	2	Constant	No	No	1	1	2
71	E. R.	9	F.	Suppurative otitis med. Pansinusitis	16 M.	Shallow	R. B. G.	25 M.	2	Constant	Yes	Yes	0	0	0
72	M. M.	10	F.	Repeated colds	15 M.	Full surgical	H. J. H.	15 M.	2	Constant	No	No	0	0	1
73	M. J.	7	M.	Nasal obstruction. Catarrhal otitis	10 M.	Shallow	H. J. H.	20 M.	2	Out of commis'n	Yes‡	Yes†	0	0	1
74	S. H.	4	M.	Nasal obstruction	12 M.	Uneven	D. B. M.	11 M.	3	Intermittent	No	No	4	4	4
75	A. B.	12	F.	Repeated colds	10 M.	Uneven	P. L.	20 M.	3	Intermittent	Yes	Yes	2	2	3
76	A. C.	7	F.	Chronic tonsillitis	10 M.	Full surgical	D. B. M.	20 M.	1	Intermittent	No	No	0	0	2
77	I. V.	8	M.	Repeated colds	12 M.	Uneven	G. K.	18 M.	2	Intermittent	No	No	2	2	3
78	P. T.	3	F.	O. M. C. C. Enlarged tonsils	10 M.	Full surgical	G. K.	20 M.	1	Intermittent	No	No	1	1	2
79	R. F.	4	F.	Repeated colds	10 M.	Uneven	D. B. M.	20 M.	1	Intermittent	No	No	4	4	4
80	M. H.	6	M.	Repeated colds	5 M.	Full surgical	O. L. K.	21 M.	1	Intermittent	No	No	1	1	2

* Yes, at the beginning.
†Yes, toward the end.
‡ Yes, at the end.

TABLE 5.—*Rose Position*

No.	Name	Age	Sex	History	Induction Time	Degree of Anesthesia	Operators	Time	Hemorrhage	Suction Applied	Vomited	Coughed	Bronchoscopy Left	Bronchoscopy Right	Bronchoscopy Trachea
81	R. H.	9	F.	Enlarged tonsils	8 M.	Light surgical	H. T. H.	13 M.	2	Intermittent	No	No	0	0	0
82	G. Z.	12	M.	Enlarged tonsils	4 M.	Full surgical	F. M. B.	34 M.	2	Intermittent	No	No	4	4	4
83	W. F.	7	M.	Nasal obstruction. Impaired hearing	7 M.	Uneven	F. M. B.	42 M.	4§	Out of commis'n	No	No	4	4	4
84	B. D.	7	M.	Nasal obstruction	6 M.	Full surgical	F. M. B.	19 M.	3	Intermittent	No	No	2	2	3
85	V. S.	11	M.	Repeated colds. Nasal obstruction	8 M.	Shallow	F. M. B.	11 M.	2	Intermittent	No	Yes†	1	1	2
86	C. P.	4	F.	Bil. suppurative. Otitis M. chronic	3 M.	Shallow	C. T. H.	27 M.	2	Constant	Yes†	Yes	0	0	0
87	E. P.	11	F.	Chronic tonsillitis	12 M.	Light surgical	C. T. H.	20 M.	2	Constant	No	No	0	0	0
88	S. R.	6	F.	Nasal obstruction	8 M.	Full surgical	C. T. H.	23 M.	2	Intermittent	No	No	0	0	1
89	G. R.	8	F.	Referred by school nurse	5 M.	Struggling	T. H.	22 M.	2	Intermittent	Yes	Yes	0	0	0
90	R. P.	14	F.	Chronic tonsillitis	10 M.	Shallow	T. H.	28 M.	2	Intermittent	Yes	Yes	0	0	1
91	H. J.	10	M.	Neuritis of knees	10 M.	Light surgical	T. H.	25 M.	2	Constant	No	Yes‡	0	0	0
92	Y. N.	6	F.	Nasal obstruction. Repeated sore throat	7 M.	Light surgical	J. J. J.	21 M.	2	Constant	No	No	0	0	0
93	C. R.	11	F.	Repeated head colds. Tonsillitis	7 M.	Shallow	J. J. J.	23 M.	4	Constant	No	Yes†	0	0	1
94	R. K.	5	M.	Enlarged tonsils	13 M.	Uneven	G. L. C.	25 M.	2	Constant	Yes	Yes†	4	4	4
95	A. P.	6	M.	Peritonsillar abscess	13 M.	Full surgical	F. E. I.	27 M.	4	Constant	No	No	0	0	0
96	G. R.	12	F.	Bil. suppurative. Chronic otitis media	10 M.	Full surgical	O. L. K.	20 M.	4	Constant	No	No	4	4	4
97	O. S.	9	M.	Chronic foll. tonsil	13 M.	Uneven	H. J. H.	20 M.	2	Intermittent	No	Yes	1	1	2
98	E. A.	6	M.	Nasal obstruction	17 M.	Shallow	W. M.	21 M.	2	Intermittent	Yes	Yes	0	0	1
99	L. T.	11	F.	Repeated colds. Impaired hearing	15 M.	Light surgical	E. S. M.	27 M.	3	Intermittent	Yes	Yes	1	1	1
100	A. H.	5	F.	Enlarged tonsils	10 M.	Shallow	O. L. K.	12 M.	3	Out of commis'n	No	Yes	1	1	1

† Yes, toward the end.
‡ Yes, at the end.
§ Sutures taken.

TABLE 6.—*Bostonian Position*

No.	Name	Age	Sex	History	Induction Time	Degree of Anesthesia	Operators	Time	Hemorrhage	Suction Applied	Vomited	Coughed	Bronchoscopy Left	Bronchoscopy Right	Bronchoscopy Trachea
101	R. P.	5	F.	Otitis med. Suppurat. chronic	8 M.	Light surgical	R. I. H.	20 M.	1	Constant	No	Yes†	4	4	4
102	H. M.	8	F.	Nasal obstruction	10 M.	Full surgical	G. L. C.	26 M.	2	Intermittent	No	No	4	4	4
103	L. R.	6	F.	Repeated sore throat	9 M.	Full surgical	R. B. G.	18 M.	2	Intermittent	No	No	4	4	4
104	A. R.	4	M.	Repeated sore throat	7 M.	Full surgical	R. I. H.	15 M.	2	Intermittent	No	No	4	4	4
105	E. C.	7	F.	Nasal obstruction	6 M.	Light surgical	R. I. H.	18 M.	2	Constant	No	No	2	2	3
106	C. C.	10	M.	Nasal obstruction	18 M.	Full surgical	R. E. G.	22 M.	2	Constant	No	No	4	4	4
107	J. M.	7	M.	Nasal obstruction	15 M.	Shallow	G. L. C.	18 M.	2	Constant	Yes	Yes	2	2	3
108	F. S.	8	F.	Nasal obstruction	13 M.	Light surgical	F. E. I.	24 M.	2	Intermittent	No	No	2	2	3
109	F. H.	11	M.	Otitis media. Suppurative chronic	7 M.	Light surgical	H. J. H.	17 M.	2	Constant	No	No	4	4	4
110	R. S.	6	M.	Nasal obstruction	15 M.	Light surgical	E. K.	25 M.	1	Intermittent	No	No	4	4	4

† Yes, toward the end.

TABLE 7.—*Analysis of Excessively Aspirated Patients*

Case	Name	Age	Sex	Positions	Induction Time	Degree of Anesthesia	Operators	Time	Hemorrhage	Suction Applied	Vomited	Coughed	Bronchoscopy L	R	T
9	E. B.	9	M.	Moderate extension	9 M.	Light surgical	J. W. H.	11 M.	4	Intermittent	No	No	4	4	4
15	R. Q.	4	M.	Moderate extension	6 M.	Full surgical	C. B.	32 M.	2	Constant	No	No	4	4	4
16	T. H.	4	M.	Moderate extension	5 M.	Light surgical	M. E. C.	28 M.	2	Intermittent	No	No	4	4	4
18	A. D.	5	F.	Moderate extension	4 M.	Light surgical	E. B. C.	20 M.	2	Constant	No	No	4	4	4
19	C. M.	9	M.	Moderate extension	10 M.	Light surgical	J. H.	20 M.	3	Constant	No	Yes*	4	4	4
35	R. O.	14	F.	Extreme extension	25 M.	Uneven. Out of commis'n	H. J. H.	20 M.	4	Intermittent	No	Yes‡	4	4	4
43	C. B.	9	M.	Trendelenburg 20 degree	14 M.	Full surgical	H. H. H.	24 M.	4	Intermittent	No	No	4	4	4
49	O. P.	3	F.	Trendelenburg 20 degree	10 M.	Full surgical	H. H. H.	20 M.	3	Constant	No	No	4	4	4
74	S. H.	4	M.	Trendelenburg 45 degree	12 M.	Uneven	D. B. M.	11 M.	3	Intermittent	No	No	4	4	4
79	R. F.	4	F.	Trendelenburg 45 degree	10 M.	Uneven	D. B. M.	20 M.	1	Intermittent	No	No	4	4	4
82	G. Z.	12	M.	Rose	4 M.	Full surgical	F. M. B.	34 M.	2	Intermittent	No	No	4	4	4
83	W. F.	7	M.	Rose	7 M.	Uneven	F. M. B.	42 M.	4§	Out of commis'n	No	No	4	4	4
94	R. K.	5	M.	Rose	13 M.	Uneven	G. L. C.	25 M.	2	Constant	Yes	Yes†	4	4	4
96	G. R.	12	F.	Rose	10 M.	Full surgical	O. L. K.	20 M.	4	Constant	No	No	4	4	4
101	R. P.	5	F.	Bostonian	8 M.	Light surgical	R. I. H.	20 M.	1	Constant	No	Yes†	4	4	4
102	H. M.	8	F.	Bostonian	10 M.	Full surgical	G. L. C.	26 M.	2	Intermittent	No	No	4	4	4
103	L. R.	6	F.	Bostonian	9 M.	Full surgical	R. B. G.	18 M.	2	Intermittent	No	No	4	4	4
104	A. R.	4	M.	Bostonian	7 M.	Full surgical	R. I. H.	15 M.	2	Intermittent	No	No	4	4	4
106	C. C.	10	M.	Bostonian	18 M.	Full surgical	R. E. G.	22 M.	2	Constant	No	No	4	4	4
109	F. H.	11	M.	Bostonian	7 M.	Light surgical	H. J. H.	17 M.	2	Constant	No	No	4	4	4
110	R. S.	6	M.	Bostonian	15 M.	Light surgical	E. K.	25 M.	1	Intermittent	No	No	4	4	4

* Yes, at the beginning. ‡ Yes, at the end.
† Yes, toward the end. § Sutures taken.

TABLE 8.—*Analysis of Non- and Slightly Aspirated Patients*

Case	Name	Age	Sex	Positions	Induction Time	Degree of Anesthesia	Operators	Time	Hemorrhage	Suction Applied	Vomited	Coughed	Bronchoscopy L	R	T
21	A. M.	7	F.	Extreme extension	12 M.	Light Surgical	W. G. H.	30 M.	1	Intermittent	No	Yes	0	0	1
30	M. C.	14	F.	Extreme extension	10 M.	Light Surgical	S. K. B.	20 M.	2	Constant	Yes	No	0	0	0
33	M. F.	13	F.	Extreme extension	7 M.	Shallow	T. E. G.	13 M.	2	Constant	Yes	Yes	0	0	1
34	C. M.	7	M.	Extreme extension	20 M.	Light Surgical	S. K. B.	20 M.	2	Constant	No	No	0	0	1
36	R. N.	5	M.	Extreme extension	15 M.	Shallow	L. L. H.	20 M.	3	Constant	Yes	Yes	0	0	1
40	M. E.	6	F.	Extreme extension	12 M.	Light Surgical	H. J. H.	12 M.	2	Constant	No	Yes	0	0	1
45	J. B.	6	M.	Trendelenburg 20 degree	16 M.	Shallow	H. J. H.	12 M.	2	Intermittent	Yes†	Yes	0	0	0
50	N. N.	5	F.	Trendelenburg 20 degree	15 M.	Light Surgical	G. McC.	28 M.	1	Intermittent	No	No	0	0	1
53	M. S.	8	M.	Trendelenburg 20 degree	10 M.	Struggling	H. J. H.	20 M.	1	Intermittent	Yes	Yes	0	0	0
54	J. C.	10	M.	Trendelenburg 20 degree	9 M.	Struggling	J. B. O.	24 M.	1	Intermittent	Yes	Yes	0	0	0
57	H. R.	5	M.	Trendelenburg 20 degree	9 M.	Struggling	E. W. G.	18 M.	1	Intermittent	Yes	Yes	0	0	0
58	J. G.	5	M.	Trendelenburg 20 degree	9 M.	Shallow	E. W. G.	19 M.	1	Intermittent	Yes	Yes	0	0	0
59	W. M.	7	M.	Trendelenburg 20 degree	9 M.	Shallow	E. W. G.	19 M.	1	Intermittent	Yes	Yes	0	0	0
63	A. M.	11	F.	Trendelenburg 45 degree	12 M.	Shallow	E. W. G.	20 M.	2	Constant	Yes	Yes	0	0	0
64	E. B.	13	F.	Trendelenburg 45 degree	8 M.	Shallow	E. W. G.	18 M.	3	Constant	Yes	Yes	0	0	0
65	W. H.	6	M.	Trendelenburg 45 degree	5 M.	Shallow	E. W. G.	15 M.	1	Constant	Yes	Yes	0	0	0
67	B. C.	5	F.	Trendelenburg 45 degree	6 M.	Light Surgical	H. J. H.	16 M.	2	Constant	No	No	0	0	0
68	L. M.	7	F.	Trendelenburg 45 degree	8 M.	Light Surgical	M. A. O.	22 M.	2	Constant	No	No	0	0	1
71	E. R.	9	F.	Trendelenburg 45 degree	16 M.	Shallow	R. B. G.	25 M.	2	Constant	Yes	Yes	0	0	0
72	M. M.	10	F.	Trendelenburg 45 degree	15 M.	Full surgical	H. J. H.	15 M.	2	Constant	No	No	0	0	1
73	M. J.	7	M.	Trendelenburg 45 degree	10 M.	Shallow	H. J. H.	20 M.	2	Out of commis'n	Yes†	Yes†	0	0	1
81	R. H.	9	F.	Rose	8 M.	Light Surgical	H. J. H.	13 M.	2	Intermittent	No	No	0	0	0
86	C. P.	4	F.	Rose	3 M.	Shallow	C. T. H.	27 M.	2	Constant	Yes†	Yes	0	0	0
87	E. P.	11	F.	Rose	12 M.	Light Surgical	C. T. H.	20 M.	2	Constant	No	No	0	0	0
88	S. R.	6	F.	Rose	8 M.	Full surgical	C. T. H.	23 M.	2	Intermittent	No	No	0	0	1
89	G. R.	8	F.	Rose	5 M.	Struggling	T. H.	22 M.	2	Intermittent	Yes	Yes	0	0	0
90	R. P.	14	F.	Rose	10 M.	Shallow	T. H.	28 M.	2	Intermittent	Yes	Yes	0	0	1
91	H. J.	10	M.	Rose	10 M.	Light Surgical	T. H.	25 M.	2	Constant	No	Yes‡	0	0	0
92	Y. N.	6	F.	Rose	7 M.	Light Surgical	J. J. J.	21 M.	2	Constant	No	No	0	0	0
93	C. R.	11	F.	Rose	7 M.	Shallow	J. J. J.	23 M.	4	Constant	No	Yes†	0	0	1
95	A. P.	6	M.	Rose	13 M.	Full surgical	F. E. I.	27 M.	4	Constant	No	No	0	0	0
98	E. A.	6	M.	Rose	17 M.	Shallow	W. M.	21 M.	2	Intermittent	Yes	Yes	0	0	1

† Yes, toward the end
‡ Yes, at the end.

they do not assure of absolute protection against aspiration.

5. With a proper combination of the methods mentioned in these studies, aspiration hazards may be markedly reduced.

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REFERENCES

1. Collins, S. D., and Sydenstricker, Edgar. An Epidemiological and Statistical Study of Tonsillitis, Pub. Health Bull., 175, 1927. Editorial, J. A. M. A., Tonsillectomy in the United States, J. A. M. A., 91, 1195, October 20, 1928.

2. Cutler, E. C., and Hunt, A. M. Postoperative Pulmonary Complications, Arch. Surg., 1, 114, July 1920. Postopertive Pulmonary Complications, Arch. Int. Med. 29, 449, April 1922. Cutler, E. C., The Etiology of Postoperative Pulmonary Complications, S. Clin. North America, 2, 935, August 1922.

3. Schlueter, S. A., and Werdlein, I. F. Postoperative Lung Abscess—An Experimental Study. Arch. Surg., 14:457-528, February 1927.

4. Fetterolf, G., and Fox, H. The Reaction of the Paratonsillar Tissue to Tonsillectomy. A Study in the Etiology of the Post-tonsillectomy Pulmonary Abscess. Am. J. M. Sc., 166, 802, 1923.

5. Hoelscher, R. Experimentelle Untersuchung über d. Entstehung d. Erkrank. d. Luftwege in Aethernarkose. Arch. of klin. Chir., Vol. 57, 175-232, 1898.

6. Lemon, W. S. Aspiration Experimental Study. Arch. Surg., 12, 187, January 1926.

7. Smith, D. I. Experimental Aspiratory Abscess. Arch. Surg., Vol. 14, pt. 1, 231, January 1927.

8. Crowe, S. J., and Scarff, J. E. Experimental Abscess of the Lung in the Dog. Arch. Surg., Vol. 16, pt. 2, p. 176, January 1928.

9. Allen, D. S. Etiology of Abscess of the Lung. Arch. Surg., Vol. 16, pt. 2, p. 179, January 1928.

10. Ochsner, A., and Nesbit, W. Pulmonary Abscess Following Tonsillectomy. Arch. Otolaryng., Vol. 6, No. 4, p. 330, October 1927.

11. Myerson, M. C. Pulmonary Aspects of Tonsillectomy Under General Anesthesia. Laryngoscope, Vol. 32, p. 929, December 1922. Idem: Bronchoscopic Observation on the Cough Reflex in Tonsillectomy Under General Anesthesia. Laryngoscope, Vol. 34, p. 63, 1924.

12. Iglauer, Samuel. Aspiration of Blood into the Larynx and Trachea During Tonsillectomy—A Contribution to the Etiology of Lung Abscess. Ann. Otol. Rhin. and Laryng., Vol. 37, No. 1, p. 231, March 1928.

13. May, R. V., Thoburn, T. W., and Rosenberger, H. C. Aspiration During Tonsillectomy—A Roentgenologic Study. J. A. M. A., Vol. 93, p. 589, August 24, 1929.

14. Richardson, C. W. Tonsillectomy with Consideration of Its Complications. Washington M. Ann., 12, 2, 1912.

15. Moore, W. F. Pulmonary Abscess—An Analysis of Two Hundred and Two Cases Following Operative Work About the Upper Respiratory Passages. J. A. M. A., 78, 1279, April 29, 1922.

16. Cutler, E. C., and Schlueter, S. A. The Experimental Production of Abscess of the Lung. Ann. Surg., 84-256, 256-270, August 1926. Cutler, E. C., Halloway, J. W., and Schlueter, S. A. Relation of Immunity Through Experimental Production of Abscess of the Lung. Ann. Surg., Vol. 86, p. 165, August 1927.

17. Hedblom, C. A. The Surgical Treatment of Acute Pulmonary Abscess and Chronic Pulmonary Suppuration. J. A. M. A., 83, 1577, November 15, 1924.

18. Lord, F. T. Certain Aspects of Pulmonary Abscess—From Analysis of Two Hundred and Twenty-Seven Cases. Boston M. and S. J., 606, April 23, 1926. Discussion in article by Lemon, cited above.

RESUSCITATION OF THE NEW-BORN*

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THERE is no phase of obstetric practice which is more important and yet gets so little attention as does the resuscitation of the new-born child.

Fortunately most infants cry spontaneously upon being born and the circulatory changes take place without incident, but in many instances there is delay in the establishment of one or both functions and it becomes necessary to use artificial means in the attempt to preserve life.

It is not my purpose to introduce a new means of resuscitation but to recall the importance of the subject, to point out certain errors in the practice and to suggest those methods which have the most merit.

Since the birth of a living and healthy child into the world is the sole purpose of pregnancy and labor, there is necessarily a failure unless this purpose has been accomplished. To those who are called upon to attend the mother through this function, comes the responsibility of sustaining the new life; skillfully, patiently and gently using all means available.

BASIC PRINCIPLES IN TREATMENT OF ASPHYXIA NEONATORUM

There are two important principles in the treatment of the asphyxiated new-born. First, that the respiratory passages are free from blood, mucus and amniotic fluid. Second, that the body temperature be not allowed to fall below normal. In the former instance all that is usually necessary is to suspend the child by the feet, allowing the head to rest upon the table. The mouth and throat are then gently wiped free of mucus by use of two folds of gauze over the little finger, or the throat is massaged upward gently. As a rule these measures are sufficient to clear the lungs. Where there has been deep aspiration of amniotic fluid, it becomes necessary to use gentle artificial respiration during which the child is still suspended. This almost always frees the lungs of fluid. Where these maneuvers have failed to give results it may become advisable to aspirate the mucus by use of a bulb aspirator or the tracheal catheter.

During the time necessary to carry out such manipulations there has been rapid evaporation from the wet skin of the child and a rapid fall in the temperature. To prevent this fall from progressing to a dangerous point, the use of a warm water bath is the most successful.

The water bath has two distinct functions: to maintain body temperature, as already mentioned, and to stimulate respiration and circulation. If the bath is tepid it has no stimulating effect; to obtain that result, it must therefore be warm to the hand. By the addition of hot water, which raises the temperature more rapidly, the stimulat-

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